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Driven

In search of one of the most brilliant minds in lighting

Getting to know what makes someone like Mariana Figueiro tick, isn't easy, but in this instance, the lady in question made it a pleasure.

Passionate about her work, dedicated to making a difference, interested in new ideas, Figueiro is, in her own words, 'a person who never takes no as an answer; someone looking for new ways to grow, learn and move forward; a little bit of a workaholic but for a good reason; someone who believes that research and design are interchangeable and should always be hand-in-hand, and a person who strives for excellence - always.'

She's also 'someone who loves her family even though I am miles away from them.'

Below, Figueiro shares the decisions that led to her current, and I think it fair to say, exalted position as light and health program director, LRC, and Professor at Rensselaer Polytechnic Institute.

Can you tell us a little about your life 'before lighting'?

'I am originally from Brazil, where I grew up. My father is Brazilian and my mother was Cuban. I have been immersed in American culture since I was a little kid because my mother's family lives in the US. I used to visit my grandfather every July and fell in love with the American way of life.

'I studied in a Jesuit school (Loyola) until I started Architecture school in Brazil. I always thought I would spend the rest of my life working as an architect. Soon after I graduated, I was hired by one of the largest construction companies in Brazil.

'I got married at age 24. My ex-husband wanted to come to the US for an MBA. I came as a spouse and quickly began searching for a post-graduate program here at Rensselaer.

‘But in the end, someone needs to be a driving force, and that is probably one of my biggest roles here





‘That was fascinating. Light could be used to help people with Alzheimer’s disease sleep better’



‘It was then that I found the Masters of Science in Lighting program offered by the Lighting Research Center. I was accepted into the program late, but cannot thank enough those at the LRC who accepted me as a student.

‘When I started my graduate studies, I thought I would be back to Brazil as a lighting designer. Well, I fell in love with research after taking the research design class taught by LRC director, Mark Rea. I then decided to pursue a career in research and quickly realised that I wasn’t going to be able to succeed as a researcher in Brazil. That’s when I decided to stay in the US and pursue my new goal in life.

‘I completed my Master’s and was hired as research staff at the LRC. Mark Rea convinced me to obtain my PhD. He said that if I wanted to be successful in my career and have independent research, I needed to have a PhD. I took his advice and enrolled in a part-time PhD program in Multidisciplinary Science at the School of Science at Rensselaer. My advisor was in the biology department and my thesis was on light’s effects on the circadian system.’

Where did your interest in the specific area of lighting on health and wellbeing come from?

‘My interest in light’s effect on health and wellbeing began when I was working in a new-born intensive care unit (NICU) while collecting data for my Master’s thesis. I was looking at the effects of daytime and night-time light exposure on alertness and

performance of daytime and rotating shift nurses. During my data collection, I was not sleeping more than three hours in a row during an entire month! I then started appreciating how hard it was to stay up at night, and moreover, the full importance of alertness and performance in a critical care situation, like the NICU.

‘I learned a lot about circadian rhythms, why we are so miserable trying to stay awake at night, and how light can help minimise the pain of fighting our body’s need to sleep.’

I see. So what does your role at LRC involve these days?

I direct the Light and Health Program, and that means I need to write successful grant applications, design experiments, interpret data, write manuscripts, coordinate research staff activities, manage budgets and timelines, and present our work at technical conferences. I teach courses and supervise graduate students at MS and PhD levels.

‘I also teach the Light and Health Institute, a seminar for industry professionals, held twice each year in spring and autumn. I travel to visit our partners and represent the LRC at various venues.

‘Last year, we launched the Light and Health Alliance, a collaborative initiative with lighting manufacturers. The goal is to provide manufacturers with information about the topic of light and health, so that new products designed to deliver circadian

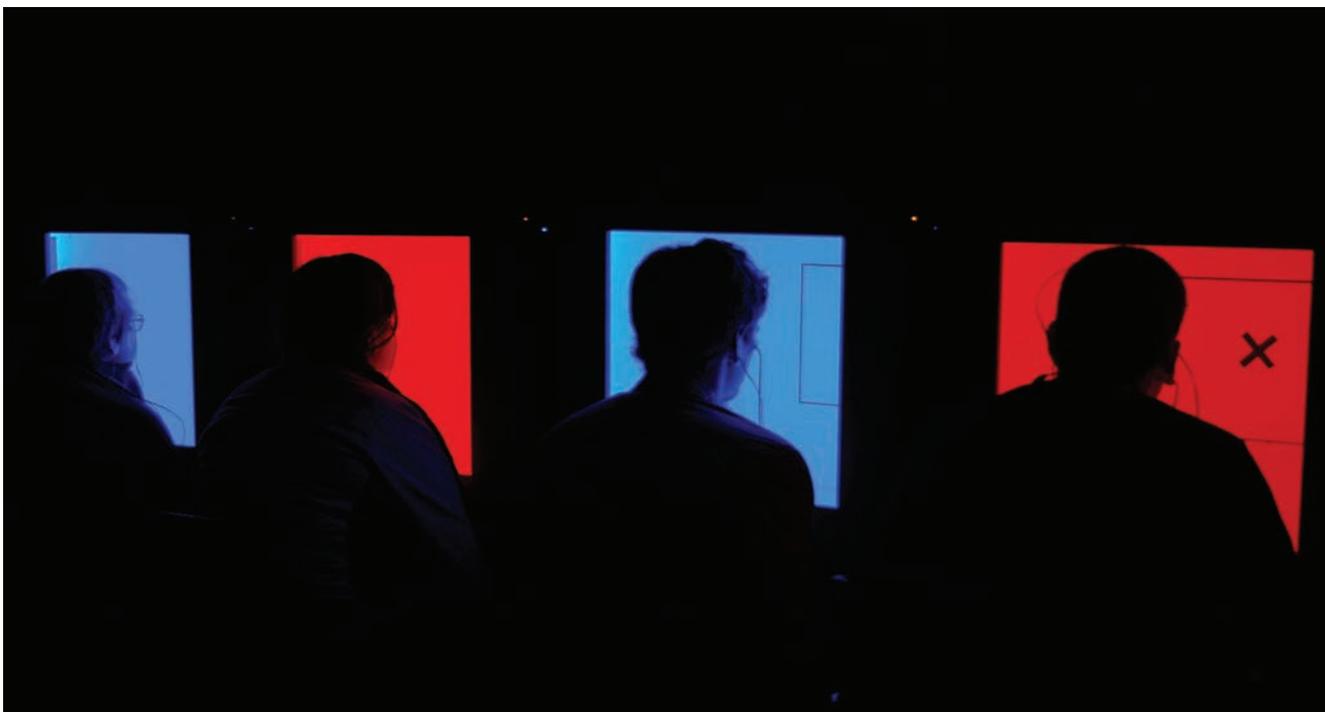
light to users can be manufactured and made available in the market.’

Can you share a little information about the research that led to your projects working with elders, and those suffering from Alzheimer’s?

When I was just starting my career at the LRC as research staff, I was charged with establishing the Light and Health Program. I was looking for applications of light that could have an impact on people’s health and wellbeing. I learned about a study published by Eus van Someren, a neuroscientist in Amsterdam, which showed that high levels of white light (above 1200 lux at the eye), could consolidate rest/activity rhythms in individuals with Alzheimer’s disease and increase sleep consolidation at night. That was fascinating. Light could be used to help people with Alzheimer’s disease sleep better.

‘Since we knew that the circadian system was maximally sensitive to short-wavelength (blue) light, we thought we could reduce the amount of light by tuning the spectrum of light to the maximum sensitivity of the circadian system.

‘Dr Nadarajah Narendran, director of research at the LRC, was working with the ASSIST Program at the LRC, and they were looking for a successful application for LEDs. Blue LEDs peaking close to 460 nm are a great light source for activating the circadian system. So we did a project together. We applied 30 lux of blue LED to individuals with Alzheimer’s disease living



in a nursing home and saw very promising results. That was the start of our work in this area.

'We then tried to get funding to continue the work, and it took us close to 10 years to finally receive funding. But, we joined efforts with clinicians and were able to receive a large amount of funding from the National Institute on Aging, to perform a study looking at the effects of light on sleep and behaviour in individuals with Alzheimer's disease.'

You were recently promoted to full Professor at Rensselaer and have been elected Fellow of the Illuminating Engineering Society. You must be very proud of your achievements; could you share an insight into what it has taken to achieve this level of success and recognition?

'Passion and excellence! And of course, a lot of hard work and dedication. But, what drives me is my passion for this topic and always making sure I do my best when running a study, writing a paper, preparing a grant proposal, advising a student or teaching a class.'

You have received many awards, including the 2007 NYSTAR James D Watson Award, the 2008 Office of Naval Research Young Investigator Award, and the 2010 Rensselaer Polytechnic Institute James M Tien '66 Early Career Award for Faculty. Is there one that stands out as your finest achievement to date? And if so, why?

'The Office of Naval Research Young Investigator Award is a very prestigious

award, and is associated with funding to perform research. It was a great award because it allowed me to do research in the area of light and alertness - and the results of these studies were very fruitful.

'We are currently working with the US Navy and the US Special Operations Command on follow-up studies, looking at using light to increase alertness. We are also working with the Navy to change the lighting inside submarines as a result of some of these studies.'

So far-reaching effects? You've also authored an impressive list of more than 60 scientific articles. How do you find the time?

'Not many free weekends or vacation time!

'Dedication is key. It takes time, focus and a lot of dedication to write a paper. I also have great help at the LRC, including someone who edits and formats the papers for me, someone who prepares the images, and a lot of help with data analyses. So, collaboration is also key.

'But in the end, someone needs to be a driving force and that is probably one of my biggest roles here.'

What are you currently researching? Is it something you can share with our readers?

'We just got awarded another grant from the National Institute on Aging to extend our work with individuals with Alzheimer's disease. We will be looking at effective ways to deliver light and long-term (six months') light treatment to improve their sleep and

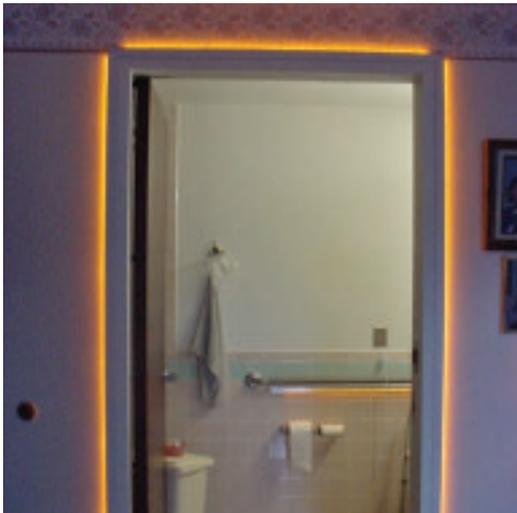
behavioral symptoms.

'We are using a light mask to deliver light through closed eyelids during sleep for older adults with early sleep onset. The goal is to deliver pulsing blue light to delay the timing of sleep in those who tend to fall asleep too early. The project is funded by the National Institute on Aging.

'Under a contract with the General Services Administration (GSA), we are measuring personal light exposures using the Daysimeter, a calibrated circadian light meter developed by the LRC, in those working in a federal building designed to increase daylight penetration into the space. We are also looking at how light exposure in buildings may affect health and wellbeing.

'We are investigating the effects of red light, which does not affect melatonin levels, on measures of alertness and performance during the day and at night. This has important implications for shift workers, because red light can increase alertness without affecting melatonin levels. The suppression of melatonin by light at night has been implicated in increased risk of breast cancer in shift workers. Red light is also a strong alerting stimulus during the post-lunch dip hours.

'We are starting to work with the Swedish Energy Agency on developing the concept and demonstration of a "healthy home." We have completed a white paper laying out what constitutes a healthy home, and are awaiting future funding to perform the



technology development and demonstration.

'We are working on developing a lighting system that can be used with premature infant incubators in the NICU, to provide cycled lighting to improve circadian function in premature infants, and to provide doctors and nurses with good visibility, including good colour, uniformity, and light levels, for infant care and surgeries.'

'We continue to investigate how night lights providing horizontal/vertical perceptual cues can reduce fall risks in older adults in the field.'

'We are working with the US Navy to determine whether light can be used to maintain circadian entrainment and improve alertness in nighttime operations.'

'We are investigating the impact of light on biomarkers associated with hunger (leptin and ghrelin), diabetes (insulin and glucose) and seasonal depression (serotonin).'

'Through a new collaborative initiative, the Light and Health Alliance, we are providing manufacturers with information about the topic of light and health, so that products designed to deliver circadian light to users can be manufactured and made available in the market.'

So not much time to spare then? How hard has it been to bridge the two sciences – light and health? There is still so much work to be done into the effects of light on health, have you encountered difficulties, or has all of the research had a positive impact?

'There are some areas that the effects of light are very clear, such as the ageing population, including individuals with Alzheimer's disease. But in other areas, such as light and performance, it is harder to show an effect.'

'The biggest challenge is to specify and control the stimulus (light) correctly. There are individual differences in how people respond to light, so understanding these differences is crucial for obtaining positive effects. Also, a lot of what we know is from laboratory studies under very controlled conditions. It is still not known how these effects can be translated from the lab to the field. Our contributions have been in translating the theory into practical applications.'

6 Convince the world that lighting is much more than vision, and that we need to pay attention to our lighted environment



Can you explain a little about TEDMED, and your involvement?

'I was invited to speak at TEDMED, a three-day event that brought together a series of speakers from diverse backgrounds, all related to human health. My talk was about how light can affect health and wellbeing. TEDMED is a sister organisation of TED.'

Rensselaer's LRC is world-renowned. Can you share a little of the background to its history, it's current role, and plan for the future?

'The Lighting Research Center at Rensselaer Polytechnic Institute was established in 1988 by the New York State Energy Research and Development Authority (NYSERDA), and, since that time, the LRC has been pioneering research in energy and the environment, light and health, transportation lighting and safety, and solid-state lighting.'

'In 1990, the LRC became the first university research centre to offer graduate degrees in lighting and, today, the LRC offers both MS and PhD programs. LRC also offers training for industry professionals, including our popular LED Lighting Institute and our new Light and Health Institute.'

'LRC's mission is to advance the effective use of light for society and the environment.'

So, what's next for you?

'Convince the world that lighting is much more than vision, and that we need to pay attention to our lighted environment!'

'I hope to continue to show to the world that lighting can be used as a non-pharmacological tool to improve people's lives in many different ways.'